11-13-06

Attorney's Docket No.: 13913-170US1 / 2001P00030 WOUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Wolfgang Pfeifer	Art Unit	: 2194
Serial No.	: 10/811,063	Examiner	: Nathan E. Price
Filed	: March 25, 2004	Conf. No.	: 8061

Title : **COMMUNICATING MESSAGE WITH TYPE, OBJECT AND IDENTIFIERS FROM BUSINESS APPLICATION TO SERVICE APPLICATION**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF PRIORITY DOCUMENT UNDER 35 USC §119

Responsive to the Office Action mailed August 8, 2006, Applicant hereby confirms his claim of priority under 35 USC §119 from the following application(s):

·European Patent Convention Application No. 01123076.0 filed September 26, 2001

A certified copy of each application from which priority is claimed is submitted herewith.

Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: Nov. 9, 2006

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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

01123076.0

Der Präsident des Europäischen Patentamts:
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

Anmeldung Nr:
Application no.: 01123076.0
Demande no:

Anmeldetag:
Date of filing: 26.09.01
Date de dépôt:

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Communicating message with type, object and identifiers from business application to service application

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

G06F15/173

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

As requested, the entries pertaining to the applicant of the above-mentioned European patent application / to the proprietor of the above-mentioned European patent have been amended to the following:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
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The registration of the changes has taken effect on 24.10.05.

COMMUNICATING MESSAGE WITH TYPE, OBJECT AND IDENTIFIERS FROM BUSINESS APPLICATION TO SERVICE APPLICATION

Field of the Invention

01 The present invention generally relates to data processing and, more particularly, relates to computer systems, computer programs, and methods to identify objects of business applications.

Background of the Invention

02 Computer applications often use object-oriented programming techniques. Data structures, hereinafter "objects", have data and functions, also referred to as properties and methods. To retrieve data from an object or to execute its method, the object has to be identified. This is especially important during run-time. Object-hierarchies are convenient. To work with an object, it must be located in the hierarchy. However, when two different run-time environments communicate, both environments need to go through the hierarchy. Communication middleware is known in the art, for example, under the terms COM, DCOM, and CORBA.

03 For example, a first run-time environment (provider) needs to communicate at multiple hierarchy levels with a second run-time environment (consumer) until the second environment operates with the identified object. Going through multiple hierarchy levels by both environments technically causes network load and delays. Also, objects in both hierarchy often operate under different technical conditions. For example, the provider uses a first object model and defines the object "identification" by a string with a predetermined number of characters; the consumer however uses a second object model and defines the

corresponding object by an integer. The difference in the object models are often caused by the use of different programming languages in both environments.

04 There is an ongoing need to provide improved identification means so that some or all of the above disadvantages are mitigated.

Summary of the Invention

05 The present invention relates to a computer system for identifying a target component in an apparatus that has components related in a hierarchy. The computer system has a first computer executing a first application to represent the components by corresponding objects, wherein the first application relates the objects in a type-object hierarchy. The system further has a second computer coupled to the first computer via a network. The first computer has a message generator that receives type-object hierarchy information from the application and that provides a message with a type chain in parent-child direction and an object chain also in parent-child direction. Both chains in combination identify a target object that corresponds to the target component. The second computer has a message interpreter that parses both chains to provide identification of the target component with type and object as well as identification of the parent components with types and objects.

06 Providing target identification as well as parent identification allows a user of the second computer to find the target component in the hierarchy of other components. The message is the common communication means for both computers. Generating and parsing the message is independent from computer operating systems, run-time

environments and programming languages.

07 Preferably, the first computer presents type-object hierarchy information to a first user and thereby adds type statements in a first language, and the second computer present identification of types in a second language.

08 Preferably, the message generator at the first computer appends an identifier type to the type chain, and appends an identifier object to the object chain.

09 The invention also relates to a method for identifying a target component in an apparatus that has components related in hierarchy. In a representing step, the components are represented by corresponding objects and the objects are thereby related in a type-object hierarchy. In a deriving message step, a message is derived from the type-object hierarchy; the message has a type chain in parent-child direction and has an object chain also in parent-child direction; both chains in combination identify a target object that corresponds to the target component. In a parsing step, the message is parsed to provide identification of the target component with type and object as well as identification of the parent components with types and objects.

010 Preferably, the identification of the target component is displayed with type statements, wherein the type statements are provided locally.

011 The invention also relates to a combination of complementary first and second computer program products, for use in a computer system to identify a target component of an apparatus that has a plurality of components related in hierarchy. Both computer program products have computer instructions that are distributed in the system as follows:

012 In the first computer program product to control a first computer, instructions represent the components by corresponding objects, and thereby relate the objects in a type-object hierarchy.

013 Also in the first computer program product, further instructions derive a message from the type-object hierarchy. The message has a type chain in parent-child direction and an object chain also in parent-child direction; both chains in combination identify a target object that corresponds to the target component.

014 In the second computer program product to control a second computer, instructions parse the message to provide identification of the target component with type and object as well as identification of the parent components with types and objects.

015 A method for identifying a target object by a first computer run-time environment to a second run-time environment has the following steps: representing a plurality of objects by the first run-time environment, thereby relating the objects in a type-object hierarchy; deriving a message from the type-object hierarchy, the message with a type chain in parent-child direction and an object chain also in parent-child direction, wherein both chains in combination identify the target object; forwarding the message to the second run-time environment; and parsing the message by the second run-time environment to provide identification of the target component with type and object as well as identification of the parent components with types and objects.

016 Preferably, both run-time environments use different object models.

Brief Description of the Drawings

017 FIG. 1 illustrates a simplified block diagram of a computer network system having a plurality of computers;

018 FIG. 2 illustrates a simplified exemplary scenario for the present invention with a first location and a second location;

019 FIG. 3 illustrates a simplified plan view of an airplane;

020 FIG.4-5 illustrate details for an application on an application computer by example, wherein FIG. 4 illustrates a type hierarchy and FIG. 5 illustrates objects;

021 FIG. 6 illustrates a message with two chains;

022 FIG. 7 illustrates details of a service computer with a service application at the second location;

023 FIG. 8 illustrates a simplified method flow chart diagram of a method of the present invention; and

024 FIG. 9 illustrates first and second documents at first and second locations in a further embodiment of the present invention.

Detailed Description of the Invention

025 For convenience, a list of references is provided prior to the claims. The current invention is useful for multi-lingual environments. In some embodiments, computers generate displays in different natural languages, such as German and English. To conveniently describe the invention in a single language, symbols ° and °° distinguish first and second natural languages, respectively. For example, "airplane°" stands for the German word "Flugzeug" and "airplane°°" stands for the English word "airplane", both

in the same meaning. In a real implementation, these superscripts are not shown.

026 The exemplary scenario relates to airplane maintenance: At an airline office, a fleet manager operates an application computer. The computer evaluates a maintenance history record that identifies an airplane component - an air valve - to be checked. The computer automatically forwards a computer message to the airport. At the airport, a service computer interprets the message and displays identification of the component to a technician.

027 In the example, the present invention provides advantages over the prior art: The service computer also displays the location of the valve in reference to a hierarchy of other airplane components such as fuselage, wing, and engine. Application and service computer may use different natural languages adapted to the understanding of manager and technician, respectively. Application and service computers may use different operating systems and run-time environments. The software can be written in different programming languages.

028 FIG. 1 illustrates a simplified block diagram of a computer network system 999 having a plurality of computers 900, 901, 902 (or 90q, with q=0...Q-1, Q any number).

029 Computers 900-902 are coupled via inter-computer network 990. Computer 900 comprises processor 910, memory 920, bus 930, and, optionally, input device 940 and output device 950 (I/O devices, user interface 960). As illustrated, the invention is present by computer program product 100 (CPP), program carrier 970 and program signal 980, collectively "program".

030 In respect to computer 900, computer 901/902 is sometimes referred to as "remote computer", computer 901/902 is, for example, a server, a router, a peer device or other common

network node, and typically comprises many or all of the elements described relative to computer 900. Hence, elements 100 and 910-980 in computer 900 collectively illustrate also corresponding elements 10q and 91q-98q (shown for q=0) in computers 90q.

031 Computer 900 is, for example, a conventional personal computer (PC), a desktop and hand-held device, a multiprocessor computer, a pen computer, a microprocessor-based or programmable consumer electronics, a minicomputer, a mainframe computer, a personal mobile computing device, a mobile phone, a portable or stationary personal computer, a palmtop computer or the like.

032 Processor 910 is, for example, a central processing unit (CPU), a micro-controller unit (MCU), digital signal processor (DSP), or the like.

033 Memory 920 symbolizes elements that temporarily or permanently store data and instructions. Although memory 920 is conveniently illustrated as part of computer 900, memory function can also be implemented in network 990, in computers 901/902 and in processor 910 themselves (e.g., cache, register), or elsewhere. Memory 920 can be a read only memory (ROM), a random access memory (RAM), or a memory with other access options. Memory 920 is physically implemented by computer-readable media, such as, for example: (a) magnetic media, like a hard disk, a floppy disk, or other magnetic disk, a tape, a cassette tape; (b) optical media, like optical disk (CD-ROM, digital versatile disk - DVD); (c) semiconductor media, like DRAM, SRAM, EPROM, EEPROM, memory stick, or by any other media, like paper.

034 Optionally, memory 920 is distributed across different media. Portions of memory 920 can be removable or non-removable. For reading from media and for writing in media,

computer 900 uses devices well known in the art such as, for example, disk drives, tape drives.

035 Memory 920 stores support modules such as, for example, a basic input output system (BIOS), an operating system (OS), a program library, a compiler, an interpreter, and a text-processing tool. Support modules are commercially available and can be installed on computer 900 by those of skill in the art. For simplicity, these modules are not illustrated.

036 CPP 100 comprises program instructions and - optionally - data that cause processor 910 to execute method steps of the present invention. Method steps are explained with more detail below. In other words, CPP 100 defines the operation of computer 900 and its interaction in network system 999. For example and without the intention to be limiting, CPP 100 can be available as source code in any programming language, and as object code ("binary code") in a compiled form. Persons of skill in the art can use CPP 100 in connection with any of the above support modules (e.g., compiler, interpreter, operating system).

037 Although CPP 100 is illustrated as being stored in memory 920, CPP 100 can be located elsewhere. CPP 100 can also be embodied in carrier 970.

038 Carrier 970 is illustrated outside computer 900. For communicating CPP 100 to computer 900, carrier 970 is conveniently inserted into input device 940. Carrier 970 is implemented as any computer readable medium, such as a medium largely explained above (cf. memory 920). Generally, carrier 970 is an article of manufacture comprising a computer readable medium having computer readable program code means embodied therein for executing the method of the present invention. Further, program signal 980 can also embody computer program 100. Signal 980 travels on network 990 to computer 900.

039 Having described CPP 100, program carrier 970, and program signal 980 in connection with computer 900 is convenient. Optionally, program carrier 971/972 (not shown) and program signal 981/982 embody computer program product (CPP) 101/102 to be executed by processor 911/912 (not shown) in computers 901/902, respectively.

040 Input device 940 symbolizes a device that provides data and instructions for processing by computer 900. For example, device 940 is a keyboard, a pointing device (e.g., mouse, trackball, cursor direction keys), microphone, joystick, game pad, or scanner. Although the examples are devices with human interaction, device 940 can also operate without human interaction, such as, a wireless receiver (e.g., with satellite dish or terrestrial antenna), a sensor (e.g., a thermometer), a counter (e.g., goods counter in a factory). Input device 940 can serve to read carrier 970.

041 Output device 950 symbolizes a device that presents instructions and data that have been processed. For example, a monitor or a display, (cathode ray tube (CRT), flat panel display, liquid crystal display (LCD), speaker, printer, plotter, vibration alert device. Similar as above, output device 950 communicates with the user, but it can also communicate with further computers.

042 Input device 940 and output device 950 can be combined to a single device; any device 940 and 950 can be provided optional.

043 Bus 930 and network 990 provide logical and physical connections by conveying instruction and data signals. While connections inside computer 900 are conveniently referred to as "bus 930", connections between computers 900-902 are referred to as "network 990". Optionally, network 990 comprises gateways being computers that specialize in data transmission and protocol conversion.

044 Devices 940 and 950 are coupled to computer 900 by bus 930 (as illustrated) or by network 990 (optional). While the signals inside computer 900 are mostly electrical signals, the signals in network are electrical, magnetic, optical or wireless (radio) signals.

045 Networking environments (as network 990) are commonplace in offices, enterprise-wide computer networks, intranets and the Internet (i.e. world wide web). The physical distance between a remote computer and computer 900 is not important. Network 990 can be a wired or a wireless network. To name a few network implementations, network 990 is, for example, a local area network (LAN), a wide area network (WAN), a public switched telephone network (PSTN); a Integrated Services Digital Network (ISDN), an infra-red (IR) link, a radio link, like Universal Mobile Telecommunications System (UMTS), Global System for Mobile Communication (GSM), Code Division Multiple Access (CDMA), or satellite link.

046 Transmission protocols and data formats are known, for example, as transmission control protocol/internet protocol (TCP/IP), hyper text transfer protocol (HTTP), secure HTTP, wireless application protocol, unique resource locator (URL), a unique resource identifier (URI), hyper text markup language HTML, extensible markup language (XML), extensible hyper text markup language (XHTML), wireless application markup language (WML), Standard Generalized Markup Language (SGML) etc.

047 Interfaces coupled between the elements are also well known in the art. For simplicity, interfaces are not illustrated. An interface can be, for example, a serial port interface, a parallel port interface, a game port, a universal serial bus (USB) interface, an internal or external modem, a video adapter, or a sound card.

048 Computer and program are closely related. As used hereinafter, phrases, such as "the computer provides" and "the program provides", are convenient abbreviation to express actions by a computer that is controlled by a program.

049 FIG. 2 illustrates the simplified exemplary scenario for the present invention with first location 10 (e.g., airline office) and second location 20 (e.g., airport). At location 10, application computer 901 has output device 951 (e.g., screen) to communicate information to a first user (e.g., manager M). Computer network 990 carries message 105 from location 10 to location 20. At location 20, service computer 902 has output device 952 (e.g., screen or printer) to communicate information to a second user (e.g., technician T).

050 Computer programs are provided as follows: Computer 901 uses business application 201 (BA), for example, a commercially available enterprise resource planning (ERP) program. Computer-program products (i.e. CPP 100) according to the invention are message generator 101 (MG) at computer 901 and message interpreter 102 (MI) at computer 902.

051 Generally, in computer system 901/902, application computer 901 executes business application 201 to represent components of an apparatus (e.g., airplane) by corresponding objects and to relate the objects in a type-object hierarchy. Message generator 101 receives type-object hierarchy information from application 201 and provides message 105 with type chain 1x and object chain 2x. Both chains in combination identify the target object that corresponds to the target component of the apparatus. Service computer 902 with message interpreter 102 parses both chains to provide identification of the target and parent components with types and objects. Computer 901

presents (e.g., screen 951) type-object hierarchy information to user M by adding type statements in a first natural language; computer 902 presents (e.g., screen 952) type identification to user T in a second natural language.

052 Besides from optionally using different languages, technically, the message communication according to the present invention is independent from the object models in both environments. There is no need to go call through multiple objects in the environment of service computer 902.

053 FIG. 3 illustrates airplane 1000 with the following components: fuselage 1400; starboard wing 1100 (right) with inner engine 1110 and outer engine 1120; port wing 1200 (left) with inner engine 1210 and outer engine 1220; cockpit 1300 with pilot-seat 1310 and co-pilot-seat 1320.

054 Each engine has a plurality of valves illustrated by circle symbols, such as fuel valve 1221 and air valve 1222 at engine 1220. For convenience of explanation, the airplane 1000 itself is considered as a root component. In the following explanation, valve 1222 is a target component.

055 FIGS. 4-5 illustrate details for application 201 on application computer 901 (location 10) by way of example. Application 201 relates objects in type-object hierarchy 110/120. Application 201 hands over hierarchy information in the form of chains to message generator 101. The figures illustrate how application 201 and generator 101 create message 105. Conveniently - but not mandatory - application 201 presents these or similar pictures to the manager (via screen 951). Conveniently, hierarchy information is symbolized by trees; persons of skill in the art can store hierarchy information by a variety of computer programming means, such as tables, variables, records, etc.

056 FIG. 4 illustrates type hierarchy tree 110 in the airplane example. Application 201 (cf. FIG. 2) represent the components by object-types, for example: airplane type (A), fuselage type (F), wing type (W), engine type (E), cockpit type (C), seat type (S), and valve type (V). An exemplary hierarchy for all airplanes is: type (A) directly above (F), (W) and (C) (i.e. A as parent); type (W) directly above (E); type (C) directly above (S); and type (E) directly above (V). The exemplary hierarchy follows the rule that a parent component contains one or more collections of child components (i.e., airplane contains fuselage, wings etc.).

057 Application 201 conveniently indicates the type by text explanations (i.e., statements) to the manager in the first language, i.e., AIRPLANE°, ..., SEAT°.

058 Hierarchy chains can be defined to each type. For example, a first type chain (arrow 11) (A), (W), (E), (V) leads to the valve type (V); a second type chain (arrow 12) (A), (C), (S) leads to the seat type (S). A type alone does not yet represent a component. Representation of components follows next:

059 FIG. 5 illustrates object hierarchy tree 120. Each type has one or more objects. For convenience, reference numbers for objects and types are similar (1xxx, 2xxx). Each object has a type. In the example, the objects are: airplane object 2000 (type A), fuselage object 2400 (type F), wing objects 2100, 2200 (type W), engine objects 2110, 2120, 2210, 2220 (type E), valve objects 2111...2222 (type V), cockpit object 2300 (type C), and seat objects 2310, 2320 (type S). The objects can have properties (not illustrated), such as to distinguish starboard and port wing, inner and outer engines, pilot and co-pilot seat, air and fuel valve etc.

060 In combination with the above type chains, object chains with object numbers identify a component. For example, the first object chain (arrow 21, objects 2000, 2200, 2220, 2222) identifies air valve 1222 (i.e. the target) by hierarchical identification. Reading the objects from left to the right, object 2000 stands for airplane 1000, object 2200 for port wing 1200, object 2220 for outer engine 1220 and object 2222 for air valve 1222. Likewise, the second object chain (arrow 22, objects 2000, 2300, 2310) in combination with the second type chain (cf. 12 in FIG. 4) identifies the pilot seat.

061 Object and type chains alone are often not sufficient to identify similar components. This is especially important for complex things like airplanes where almost all components are provided in redundancies. Representation of components by identification (ID) numbers follows next:

062 Appending an identifier type (I) to the type chain, and appending an identifier object to the object chain identifies each component. For example, the extended type chain (A), (W), (E), (V), (I) and the modified object chain (D-ABCD, 2200, 2220, 2222, 9876) stand for: the only airplane with D-ABCD (as international designation), the port wing, the outer engine, and the air valve with the identification number "9876" as the target component.

063 Message builder 101 uses both chains to compose message 105, as explained in the following:

064 FIG. 6 illustrates a simplified diagram of message 105. Message 105 comprises the type chain and the object chain with identifiers for the root component (i.e. airplane) and the target component. Examples for message 105 that identifies the air valve are:

065 Example (i)

A, D-ABCD / W, 2200 / E, 2220 / V, 2222 / I, 9876

First delimiter (comma) stand between type and object; second delimiter (slash) indicate hierarchy.

066 Example (ii), cf. FIG. 6

A, W, E, V, I

/

D-ABCD, 2200, 2220, 2222, 9876

Message 105 is separated into two portions (slash): one for the type chain, the other for the object chain.

067 Example (iii)

Airplane, Wing, Engine, Valve, Identifier

/

D-ABCD, port wing, outer engine, air valve, 9876

Message 105 is also separated into two portions, types and objects are given in long form.

068 Example (iv)

A, W, E, V, I

/

D-ABCD, 2, 2, 2, 9876

Message 105 is separated into two portions, references are abbreviated: wing 2 (out of wings 1 and 2), engine 2 (out of engine 1 and 2 on wing 2), valve 2 (out of many others)

069 Example (v)

Message 105 is divided into two separate messages that are communicated consecutively. The first message communicates the types "Airplane, Wing, Engine, Valve, Identifier" in that order. The second message communicates to use content "D-ABCD, 2200, 2220, 2222, 9876" in combination with the type order.

070 As in the examples (i) to (v), the message uniquely identifies the target component by a unique path. The path has all elements (type, object, ID) to navigate to the

target. Persons of skill in the art can provide other message formats without departing from the present invention. Especially, the delimiter characters (slash, comma) can be replaced by others. Also, persons of skill in the art can add routing or other address information so that (a) message 105 reaches interpreter 102 at service computer 902 and (b) - optionally - interpreter 102 returns a response to application computer 901. This is especially useful for the user of computer 902 (i.e. technician) to acknowledge message receipt or to return comments.

071 Portions of two messages can be identical. As long as one portion is different, the component is properly identified. For example, the message "Airplane, landing gear, wheel, air valve, I / D-ABCD, 2, 2, 2, 9876" identifies a completely different air valve, one that keeps the air pressure in one of the wheel of the left gear.

072 Preferably, message 105 is implemented as a string of characters. In respect to the above mentioned different run-time environment with different object-models, the string format is common for both environments. For example, application 201 (at computer 901) implements identification object "9876" as an integer, while interpreter 102 in the environment of computer 902 uses a string format with a limited number of characters. In other words, both object models (in both environments) are mapped.

073 FIG. 7 illustrates details of service computer 902 with service application 202 at second location. Illustrated is the display provided to device 952. Message interpreter 102 at computer 902 (cf. FIG. 2, MI) is part of service application 202. Application 202 and interpreter 102 can be the same. Interpreter 102 (or "parser") evaluates message 105 and provides information to the second user (i.e.

technician). Thereby, interpreter 102 serves the following purposes: First, to communicate identification and hierarchy relation to the second user (i.e. technician), and second, to translate terms for types or objects into appropriate natural language.

074 Interpreter 102 has program code to translate the first chain into terms that are understood by the second user; Interpreter 102 has further program code to relate the second chain to the terms.

For example, interpreter provides the following output to the technician (on device 952, second language)

075

AIRPLANE°°	D-ABCD
WING°°	port°°
ENGINE°°	outer°°
CHECK°°	air valve°°
IDENTIFICATION°°	9876

Interpreter 102 has added predefined instruction "CHECK" to the technician (second user).

076 FIG. 8 illustrates a simplified method flow chart diagram of a method of the present invention. Method 400 for identifying target component 1222 in apparatus 1000 that has components 1xxx related in hierarchy comprises representing components by objects in hierarchy; deriving a message with type and object chains from hierarchy; and parsing the message to identify the target component.

077 Details for method 400 are explained referring to the first example:

Step representing 410 components 1xxx by corresponding objects 2xxx, thereby relating objects 2xxx in type-object hierarchy 110/120 (cf. FIGS. 4-5);

Step deriving 420 message 105 from type-object hierarchy 110/120, message 105 with type chain 11 in parent-child direction and object chain 21 also in parent-child direction, wherein both chains 11, 21 in combination identify target object 2222 that corresponds to target component 1222; and

Step parsing 430 message 105 to provide identification of target component 1222 with type (V) and object 2222 as well as identification of the parent components with types (A)(W)(E) and objects 2000, 2200, 2220.

078 Optionally, method 400 further comprises to display the identification of the target component (cf. FIG. 7) with type statements (e.g., AIRPLANE°°). The type statements are provided locally that means by service computer 902. For example, persons of skill in the art can use a look-up table to store statements (in °° language) that correspond to the types.

079 Having described the present invention with respect to identifying a component is convenient, but not necessary. The present invention can also be described as identifying target object 2222 by a first computer run-time environment (i.e. computer 901 with operating system) to a second run-time environment (i.e. computer 902 with operating system) by the following steps:

080 Representing 410 (cf. FIG. 8) plurality of objects 2xxx by the first run-time environment, thereby relating objects 2xxx in a type-object hierarchy (110/120);

081 Deriving 420 message 105 from the type-object hierarchy, message 105 with type chain 11 in parent-child direction and object chain 21 also in parent-child direction, wherein both chains 11, 21 in combination identify target object 2222;

082 Forwarding message 105 to the second run-time environment (cf. FIG. 2); and

083 Parsing 430 message 105 by the second run-time environment to provide identification of target component 1222 with types (V) and objects 2222 as well as identification of the parent components with types (A)(W)(E) and objects 2000, 2200, 2220.

084 It is an advantage of the present invention, that first and second run-time environments optionally use different object models.

085 FIG. 9 illustrates first and second documents at first and second locations in a further embodiment of the present invention. Instead of identifying a target component in an apparatus (e.g., airplane) with components, the present invention also allows to identify entries in documents (i.e. tables) that relate the entries in hierarchy. As in FIG. 9, the user of computer 901 (e.g. manager) selects an entry in a first table, message 105 conveys this information to computer 902 that presents the selection in a different environment (here: different language) to the technician.

References

11, 12	type chains
21, 22	object chains
10	first location
101	message generator (MG)
102	message interpreter (MI)
105	message
110	type hierarchy tree
120	object hierarchy tree
1xxx	airplane components
1222	target component
20	second location
201	business application (BA)
202	service application
2xxx	objects
400, 4xx	method, steps
9876	exemplary identification
9xx	computer hardware, for example
901	application computer
902	service computer
951, 952	output devices
990	network

A, F, W, E, C, S, V, I	types
M, T	first and second users
x	any digit

Claims

1. A computer system (901/902) for identifying a target component (1222) in an apparatus (1000) that has components (1xxx) related in hierarchy,
the computer system (901/902) with
a first computer (901) executing a first application (201) in that objects (2xxx) represent corresponding components (1xxx), wherein the first application (201) relates the objects (2xxx) in a type-object hierarchy (110/120); and
a second computer (902) coupled to the first computer (901) via a network (990),
the computer system (901/902) characterized in that
the first computer (901) has a message generator (101) that receives type-object hierarchy information from the application (201) and that provides a message (105) with a type chain (11) in parent-child direction and an object chain (21) also in parent-child direction, wherein both chains (11, 21) in combination identify a target object (2222) that corresponds to the target component (1222); and
the second computer (902) has a message interpreter (102) that parses both chains (11, 22) to provide identification of the target component (1222) with type (V) and object (2222) as well as identification of the parent components with types ((A)(W)(E)) and objects (2000, 2200, 2220).

2. The computer system (901/902) of claim 1, wherein the first computer (901) presents type-object hierarchy information (110, 120) to a first user and thereby adds type statements in a first language (°), and wherein the second computer (902) present identification of types in a second language (°°).

3. The computer system (901/902) of claim 1, wherein the message generator (101) at the first computer (901) appends an identifier type (I) to the type chain (11), and appends an identifier object (1222) to the object chain (21).

4. A method (400) for identifying a target component (1222) in an apparatus (1000) that has components (1xxx) related in hierarchy, the method comprising the following steps:

representing (410) the components (1xxx) by corresponding objects (2xxx), thereby relating the objects (2xxx) in a type-object hierarchy (110/120);

deriving (420) a message (105) from the type-object hierarchy, the message with a type chain (11) in parent-child direction and an object chain (21) also in parent-child direction, wherein both chains (11, 21) in combination identify a target object (2222) that corresponds to the target component (1222); and

parsing (430) the message to provide identification of the target component (1222) with type (V) and object (2222) as well as identification of the parent components with types ((A)(W)(E)) and objects (2000, 2200, 2220).

5. The method of claim 4, further comprising to display the identification of the target component with type statements, wherein the type statements are provided locally.

6. A combination of complementary first and second computer program products (101, 102), for use in a computer system (901/902) to identify a target component (1222) of an apparatus (1000) that has a plurality of components (1xxx) related in hierarchy, both computer program products (101, 102) having computer instructions that are distributed in the system (901/902) as follows:

in the first computer program product (101) to control a first computer (901), instructions to represent (410) the components (1xxx) by corresponding objects (2xxx), and thereby to relate the objects (2xxx) in a type-object hierarchy (110/120);

in the first computer program product (101), further instructions to derive (420) a message (105) from the type-object hierarchy, the message with a type chain (11) in parent-child direction and an object chain (21) also in parent-child direction, wherein both chains (11, 21) in combination identify a target object (2222) that corresponds to the target component (1222); and

in the second computer program product (102) to control a second computer (902), instructions to parse (430) the message to provide identification of the target component (1222) with type (V) and object (2222) as well as identification of the parent components with types ((A)(W)(E)) and objects (2000, 2200, 2220).

7. A method for identifying a target object (2222) by a first computer run-time environment (901) to a second run-time environment (902) by the following steps:
representing (410) a plurality of objects (2xxx) by the first run-time environment, thereby relating the objects (2xxx) in a type-object hierarchy (110/120);
deriving (420) a message (105) from the type-object hierarchy, the message with a type chain (11) in parent-child direction and an object chain (21) also in parent-child direction, wherein both chains (11, 21) in combination identify the target object (2222);
forwarding the message (105) to the second run-time environment (902); and
parsing (430) the message by the second run-time environment to provide identification of the target component (1222) with type (V) and object (2222) as well as identification of the parent components with types ((A)(W)(E)) and objects (2000, 2200, 2220).

8. The method of claim 7, wherein first and second run-time environments use different object models.

COMMUNICATING MESSAGE WITH TYPE, OBJECT AND IDENTIFIERS FROM BUSINESS APPLICATION TO SERVICE APPLICATION

Abstract of the Disclosure

Generally, in a computer system (901/902), a first computer (901) executes a business application (BA, 201) to represent components of an apparatus by corresponding objects and to relate the objects in a type-object hierarchy. A message generator (MG, 101) receives type-object hierarchy information from the application (201) and provides a message (105) with a type chain (1x) and an object chain (2x). Both chains (1x, 2x) in combination identify a target object that corresponds to a target component of the apparatus. A second computer (902) with a message interpreter (102) parses both chains (1x, 2x) to provide identification of the target component as well as identification of parent components with type and objects. The second computer (901) presents (951) type-object hierarchy information to a first user (M) by adding type statements in a first natural language; the second computer (902) presents (952) type identification to a second user (T) in a second natural language.

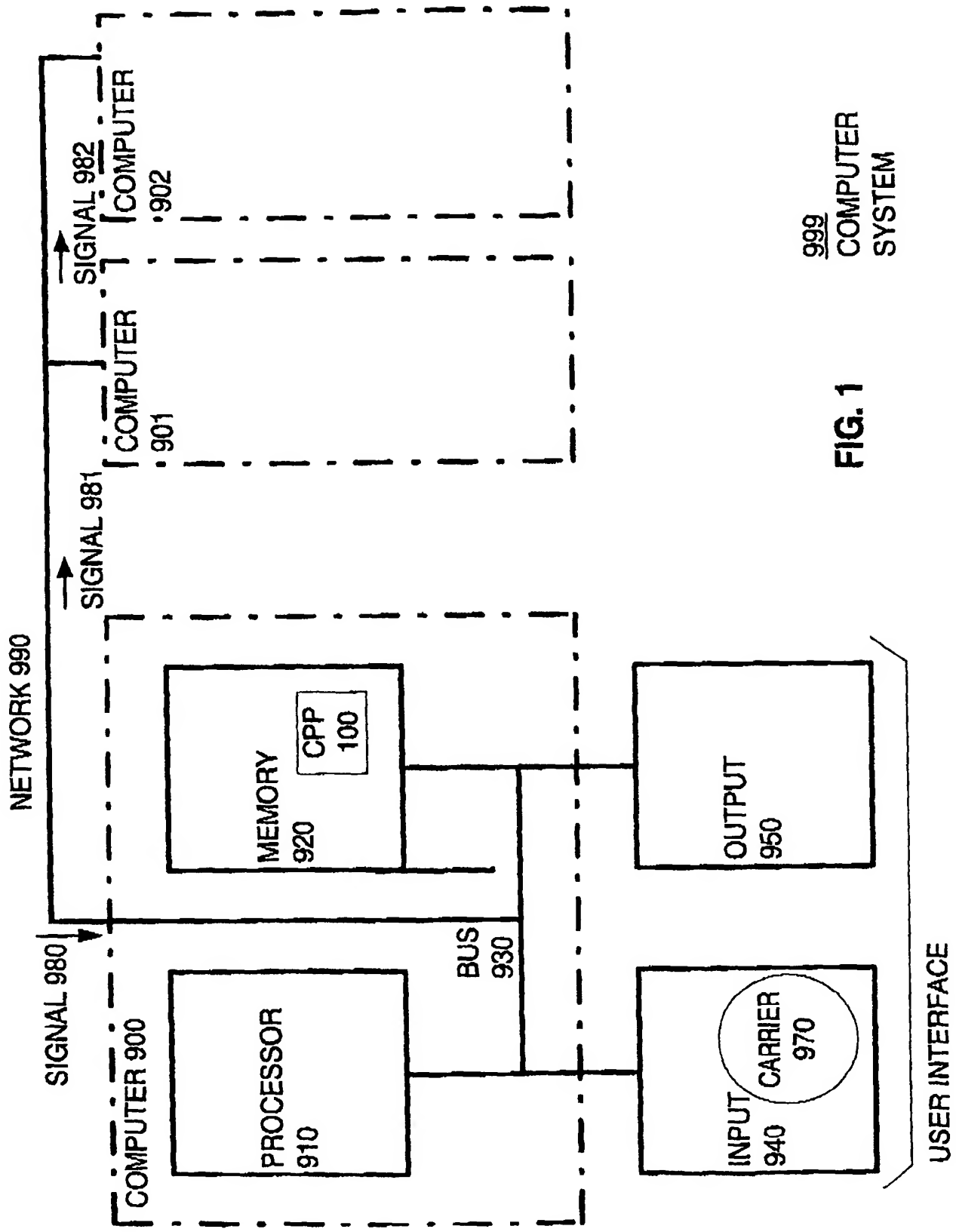
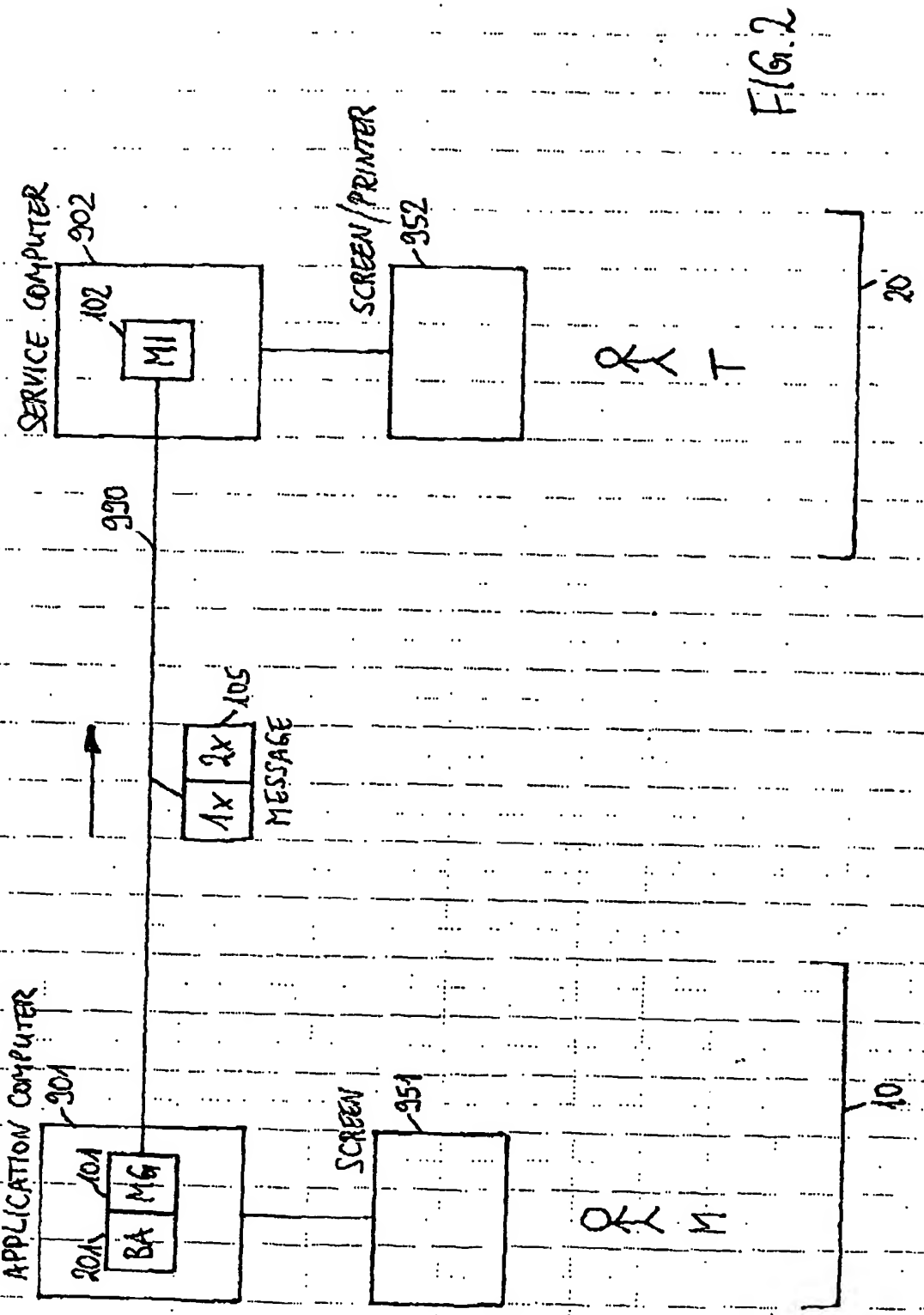

999
COMPUTER
SYSTEM
COMPUTER
902
SIGNAL 982
COMPUTER
901
SIGNAL 981
NETWORK 990
MEMORY
920
CPP
100
OUTPUT
950
BUS
930
SIGNAL 980
COMPUTER 900
PROCESSOR
910
INPUT
940
CARRIER
970
USER INTERFACE
960

FIG. 1

FIG.2


SERVICE COMPUTER
902
102
M1
SCREEN/PRINTER
952
20
930
105
2x
1x
MESSAGE
APPLICATION COMPUTER
901
101
M6
BA
201
SCREEN
951
10

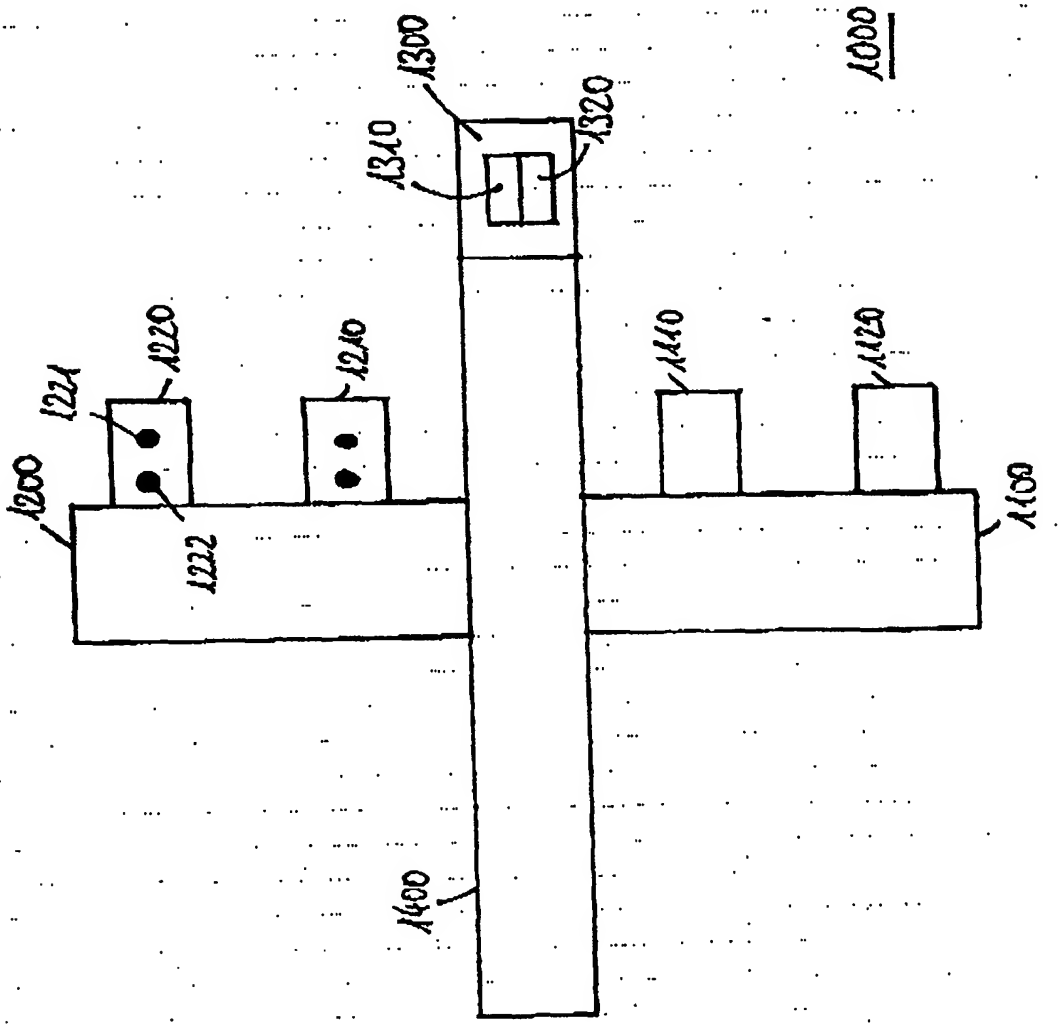
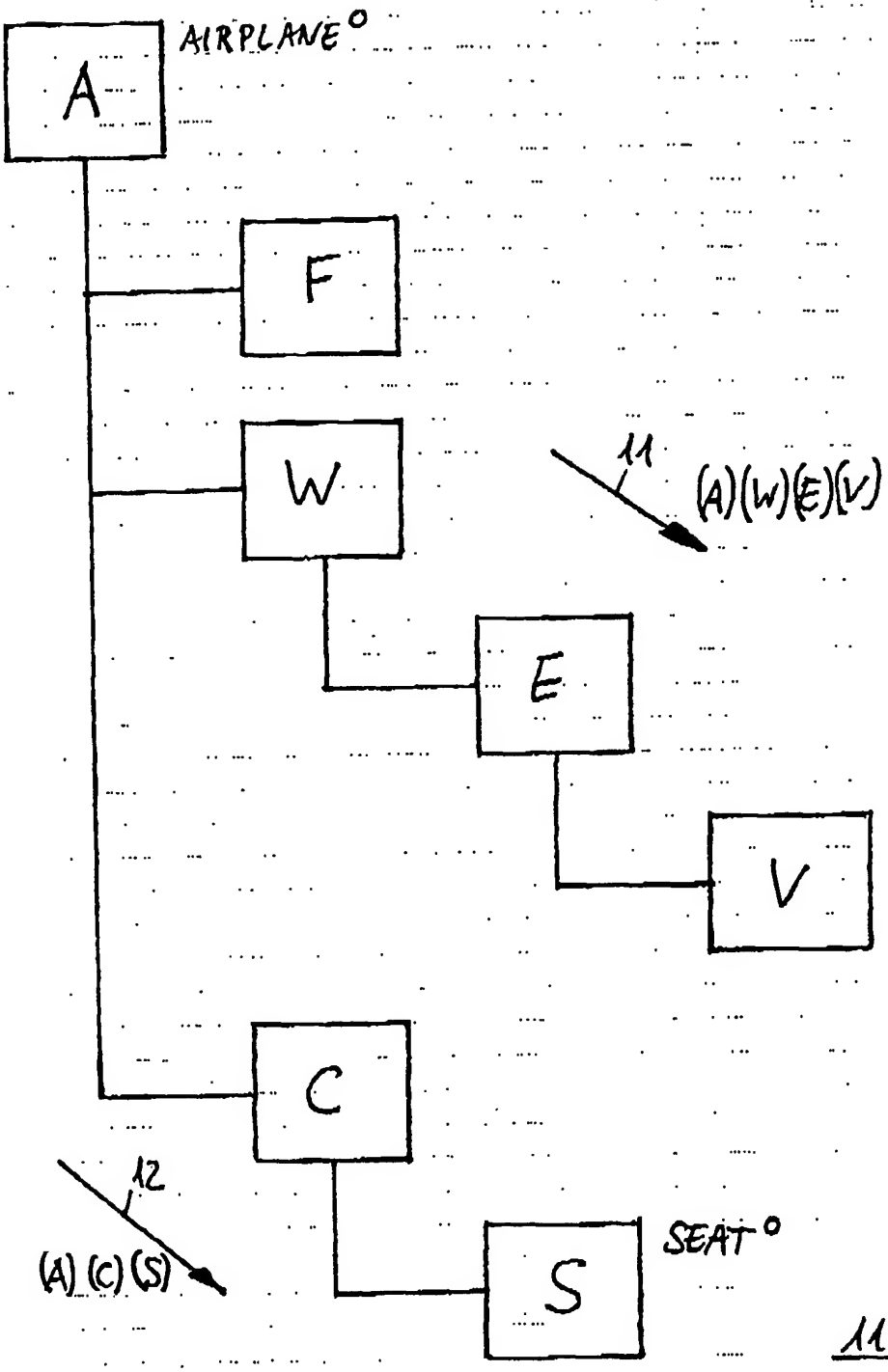

1000
1300
1320
1340
1220
1240
1224
1222
1200
1440
1420
1100
1400

FIG. 3



110 FIG.4

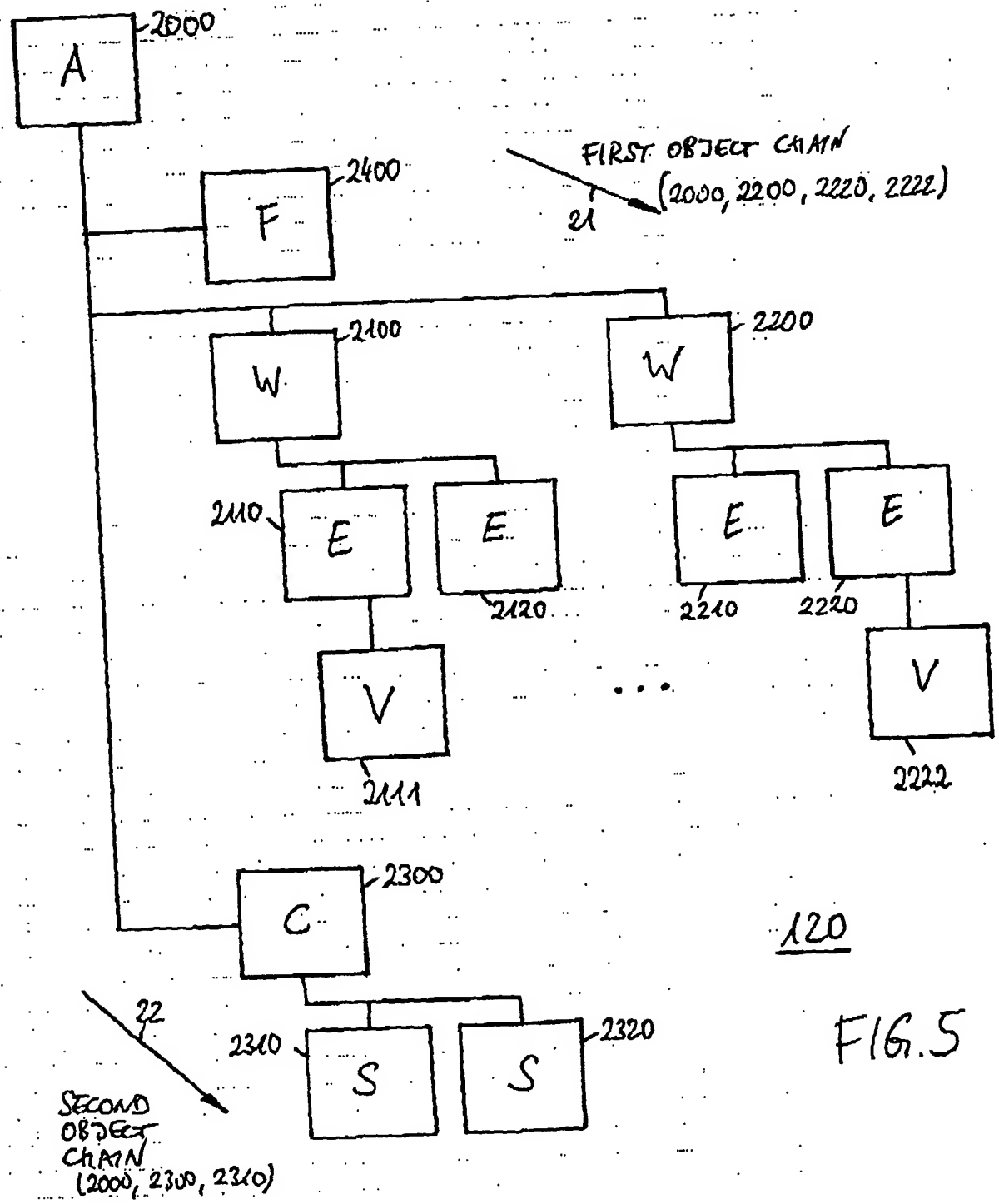

A
2000
F
2400
FIRST OBJECT CHAIN
(2000, 2200, 2220, 2222)
21
W
2100
W
2200
2110
E
E
E
E
2120
2210
2220
V
V
2111
2222
C
2300
120
22
2310
S
S
2320
SECOND OBJECT CHAIN
(2000, 2300, 2310)

FIG.5

A, W, E, V, I TYPE CHAIN	D-ABCD, 2200, 2220, 2222, 9876 OBJECT CHAIN

105

FIG. 6

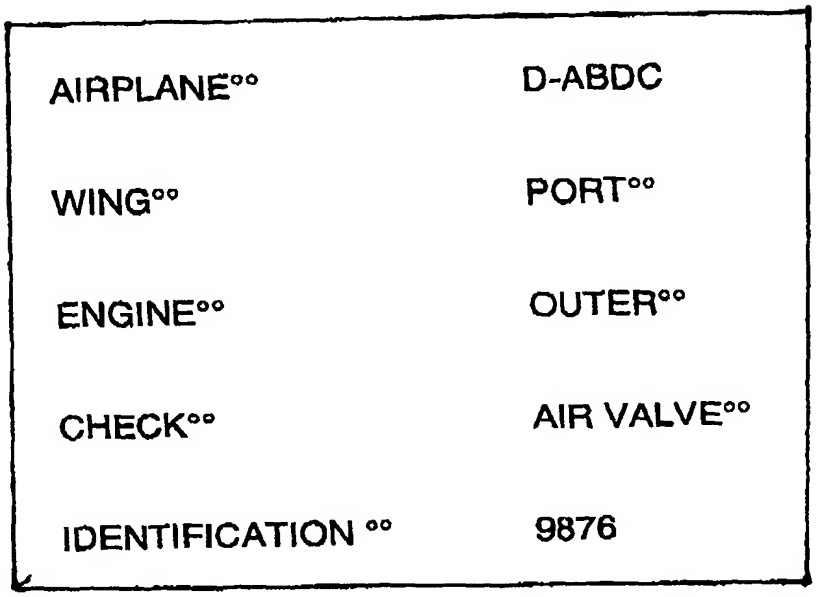

AIRPLANE°° D-ABDC
WING°° PORT°°
ENGINE°° OUTER°°
CHECK°° AIR VALVE°°
IDENTIFICATION °° 9876
952

FIG. 7

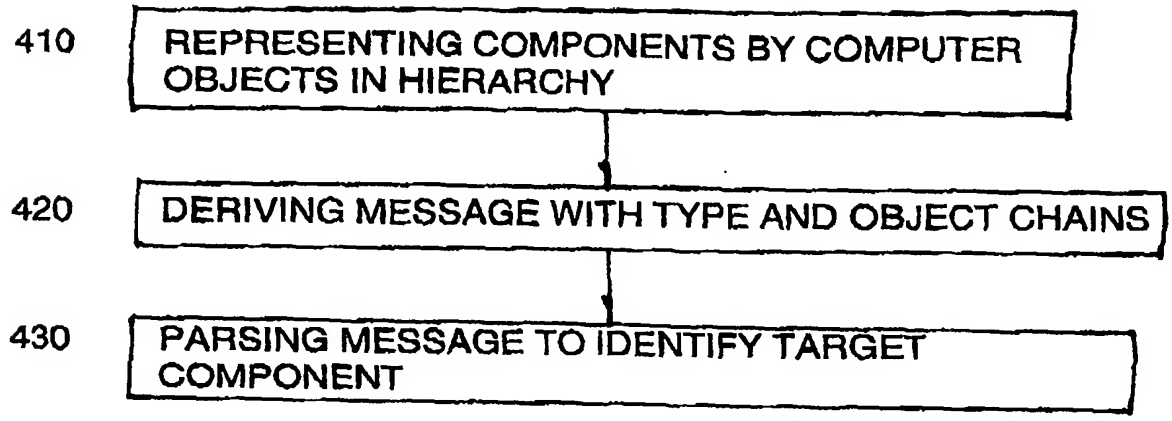
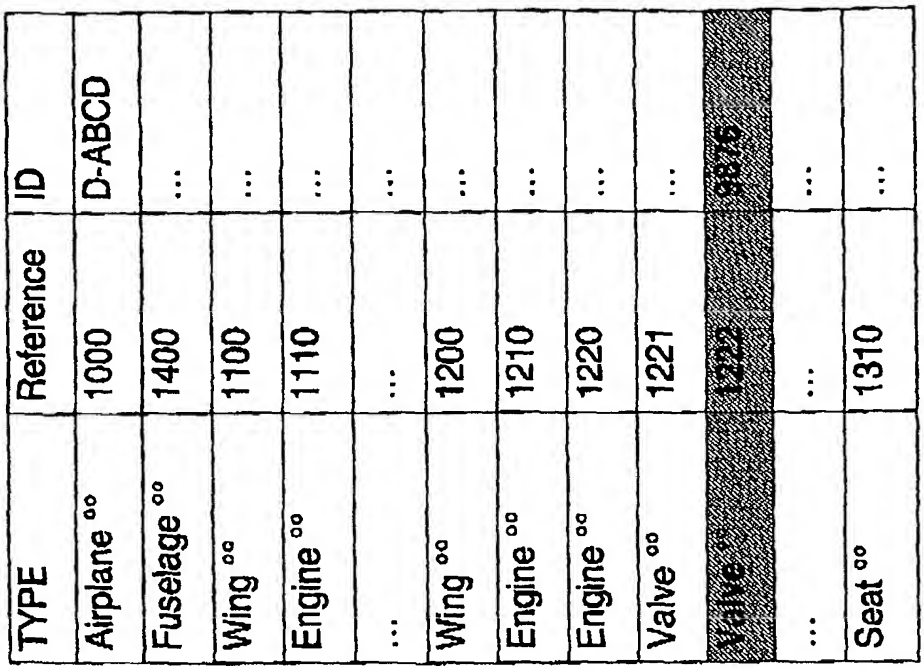
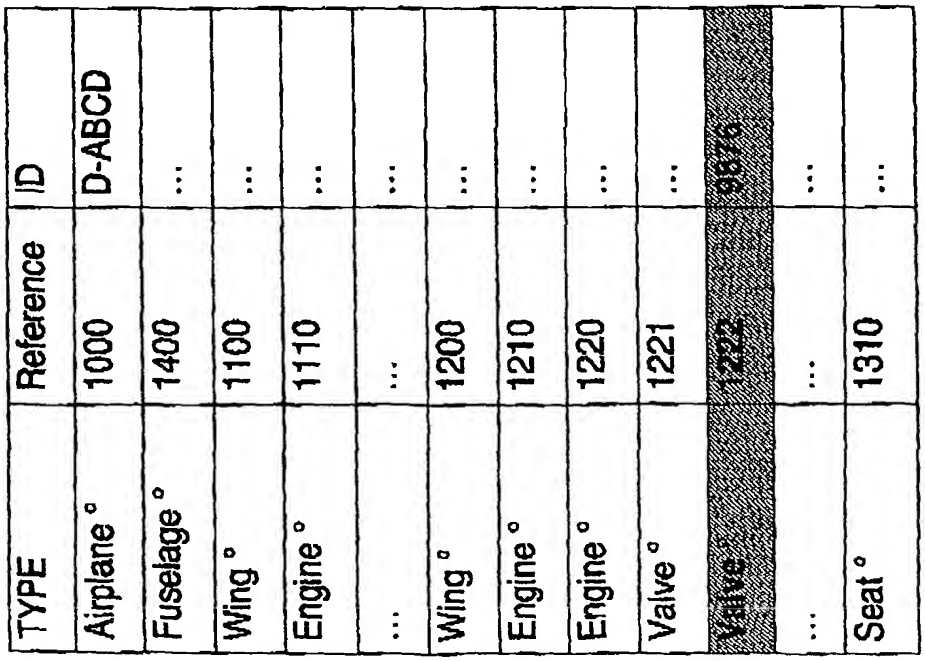

410
REPRESENTING COMPONENTS BY COMPUTER OBJECTS IN HIERARCHY
420
DERIVING MESSAGE WITH TYPE AND OBJECT CHAINS
430
PARSING MESSAGE TO IDENTIFY TARGET COMPONENT
400

FIG. 8



TYPE	Reference	ID
Airplane °°	1000	D-ABCD
Fuselage °°	1400	...
Wing °°	1100	...
Engine °°	1110	...
...	...	...
Wing °°	1200	...
Engine °°	1210	...
Engine °°	1220	...
Valve °°	1221	...
Valve °°	1222	9876
...	...	...
Seat °°	1310	...



TYPE	Reference	ID
Airplane °	1000	D-ABCD
Fuselage °	1400	...
Wing °	1100	...
Engine °	1110	...
...	...	...
Wing °	1200	...
Engine °	1210	...
Engine °	1220	...
Valve °	1221	...
Valve °	1223	9876
...	...	...
Seat °	1310	...

FIG. 9